

Applicant:

Adams et al.

For:

A Filter System With Reduced Switch Thermal Noise
and a $\Sigma\Delta$ Modulator Using Such a Filter

1. A filter system with reduced switch thermal noise comprising:
- an input circuit for receiving an input signal and a feedback signal and providing a signal representative of the difference;
 - a filter circuit including at least an input sampling capacitor and switch which introduces thermal noise error;
 - a feedback circuit, responsive to said filter circuit, for delivering to said input circuit said feedback signal; and
 - said input circuit including means for amplifying said difference signal, before it is submitted to said filter circuit to reduce the input-referred thermal noise by a factor of approximately the gain of the amplification.
2. The filter system with reduced switch thermal noise of claim 1 in which said gain is greater than one.
3. The filter system with reduced switch thermal noise of claim 1 in which said input circuit includes a summing circuit for receiving an input signal and a feedback signal and providing a signal representative of the difference and an amplifier circuit for amplifying said difference signal, before it is submitted to said filter circuit to reduce the input-referred thermal noise by a factor of approximately the gain.

noise comprising:

an input circuit for receiving an input signal and a quantized feedback signal and providing a signal representative of the difference;

a quantizer circuit for quantizing the output of said filter circuit;

a feedback circuit, responsive to said quantizer circuit, for delivering

said input circuit including means for amplifying said difference

AD-200J
jsi:abh
dr.1 12/18/98

7. A filter system with reduced switch thermal noise comprising:

- a summing circuit for receiving an input signal and a feedback signal and providing a signal representative of the difference;
- a filter circuit including at least an input sampling capacitor and switch which introduces thermal noise error;
- a feedback circuit, responsive to said filter circuit, for delivering to said summing circuit said feedback signal; and
- an amplifier circuit for amplifying said difference signal, before it is submitted to said filter circuit to reduce the input-referred thermal noise by a factor of approximately the gain of said amplifier circuit.

8. The filter system with reduced switch thermal noise of claim 7 in which said amplifier circuit has a gain greater than one.

9

9 A $\Sigma\Delta$ modulator with a filter system having reduced switch thermal noise comprising:

a summing circuit for receiving an input signal and a quantized feedback signal and providing a signal representative of the difference;

a filter circuit including at least an input sampling capacitor and switch which introduces thermal noise error;

a quantizer circuit for quantizing the output of said filter circuit;

a feedback circuit, responsive to said quantizer circuit, for delivering to said summing circuit said quantized feedback signal; and

an amplifier circuit for amplifying said difference signal, before it is submitted to said filter circuit to reduce the input-referred thermal noise by a factor of approximately the gain of said amplifier circuit..

10. A $\Sigma\Delta$ modulator with a filter system having reduced switch thermal noise as defined in claim 9 in which said amplifier circuit has a gain greater than one.